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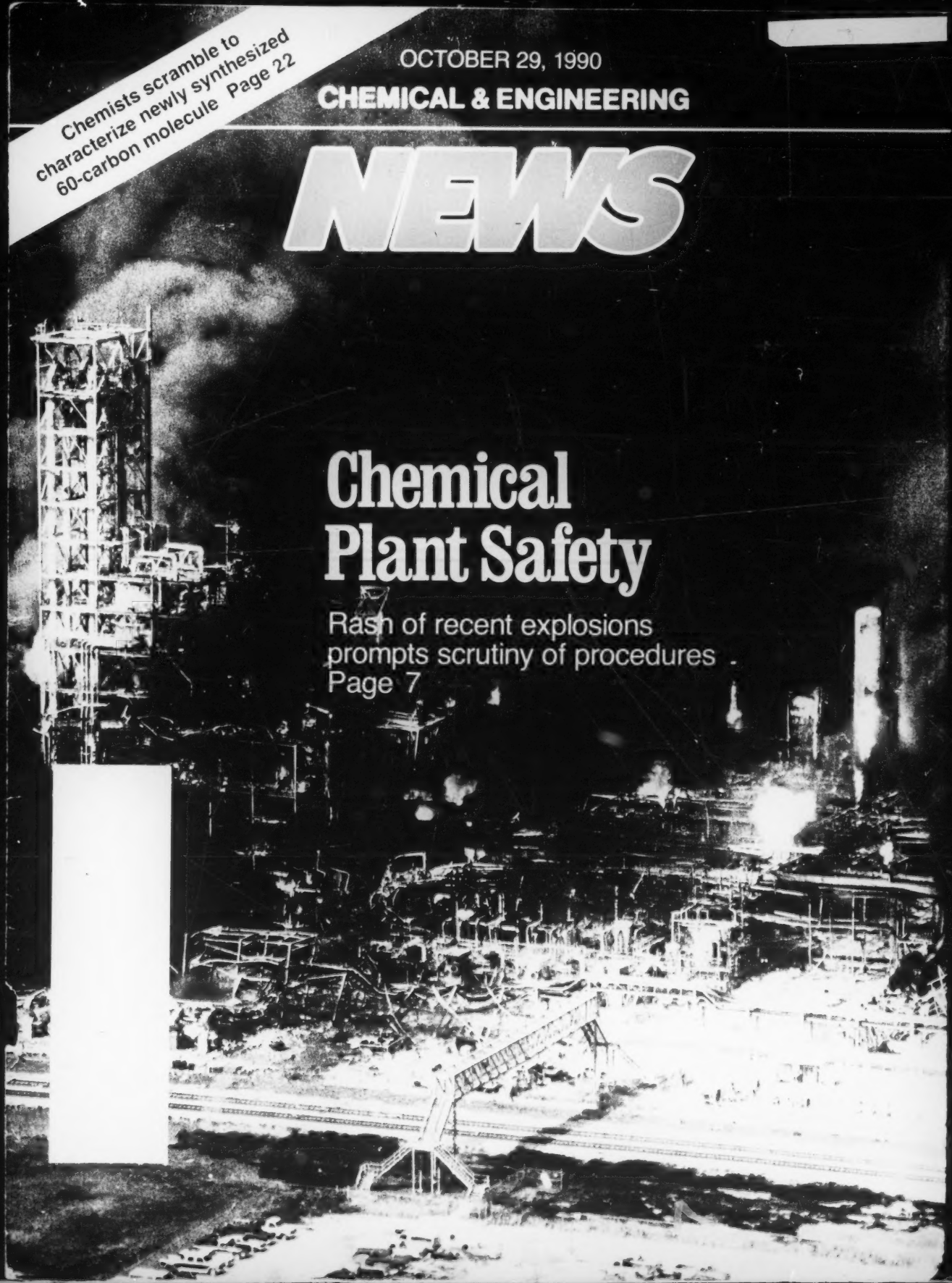
CHEMICAL & ENGINEERING
NEWS

Chemists scramble to characterize newly synthesized 60-carbon molecule Page 22



Chemical Plant Safety

Rash of recent explosions prompts scrutiny of procedures Page 7

CHEMICAL & ENGINEERING
NEWS
OCTOBER 29, 1990

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News of the Week

■ **Congress passes first Clean Air Act revision in 13 years; massive bill tightens limits on vehicle and factory emissions, attacks causes of acid rain and ozone destruction.** **Page 4**

■ **Federally funded R&D activities are faring well in 1991 budget, with all agencies funded so far getting increases.** **Page 5**

■ **Monsanto scientists conduct successful first field tests of genetically altered cotton that produces a protein toxic to many caterpillar species.** **Page 6**

■ **Worst of drop in profits for petrochemical makers may be over, with easing of crude oil prices and gradual increase in some product prices.** **Page 6**

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Science/Technology

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Cover: Explosion and fire at Phillips 66 polyethylene facility in Pasadena, Tex., in October 1989. Photo by *Houston Chronicle*

News Focus

Recent spate of plant explosions has heightened concern over the safety of petrochemical plant operations, prompted action by business, government, labor, and other groups. **Page 7**

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LETTERS

California Proposition 128

In the article on California Proposition 128 (so-called "Big Green") by Rudy Baum (C&EN, Sept. 24, page 7), the author says, "They can be forgiven for their lapse in civic responsibility because the act is numbingly legalistic. But understanding its provisions is important, because if they become law, they will affect virtually every aspect of life in the state."

Unfortunately, it is highly unlikely that they will understand this initiative at all, based upon our experience with the actual provisions of a previous initiative, Proposition 65. Its requirements are poorly understood right now, after it has become law. I am currently taking a graduate-level environmental engineering class, and my classmates who are practicing environmental engineers do not understand the provisions of Proposition 65. The layman is going to be totally confused.

As I write this letter, I still have not received my booklet from the Secretary of State containing the text of all of the measures on the ballot. Based upon past experience, I won't get that package until one week before the election. That gives me one week to read all of the material and try to reach some sort of intelligent decision. The average person won't even give it that much effort, because the text of the initiatives is straight legalese, and very difficult to read.

So the vast majority of the voters rely on the TV advertisements to get their information. The TV news and the newspapers won't devote more than a token effort to any initiative, because it is so boring, and the sports scores will sell more advertising. The legal initiatives are judged just as any candidate would be—on popularity and having the right buzzwords.

If the picture that I'm painting depresses you, it should! California's citizens may be getting the kind of government that we deserve, to paraphrase Winston Churchill, but those of us who desire to understand what it is that we are voting on are thwarted at every step.

In order to reach everybody who cares to pay attention, a very complicated issue must be explained in simple words and less than 30 seconds (the length of a TV commercial). The spokesperson must not be tainted by any connection to a chemical industry (they will be labeled as stooges and dupes anyway by the environmentalists). The whole situation precludes any understanding of technical issues, because they are complex by their very nature.

My prediction is that Propositions 128 and 130 will pass because they appear to be doing something to improve the environment. Since the majority of voters in California are in the Los Angeles and San Francisco metropolitan areas (urban people, removed from the realities of farming, timbering, and oil production), the initiatives can be passed solely on the votes of people with little or no knowledge of the impact.

The writing is on the wall: California is going to be an increasingly difficult place for chemical professionals to work. Our electorate is allowing itself to be misled on environmental issues by virtue of the very emotional nature of these problems. The result of this political mess is economic recession, which is already here. If we continue to emplace poorly worked out, technically unfeasible legislation, the future will be very bleak indeed. California—and the world—needs real, well-designed solutions to our environmental problems, not knee-jerk actions written by people detached from the consequences of their actions.

Eric A. Anderson
Pasadena, Calif.

Science education

In an article by James Krieger (C&EN, June 11, page 27) many of the problems that science education in general and chemistry in particular now face were highlighted. One problem often cited is that the current general chemistry curricula need major overhauling. Most students who take chemistry are nonchem-

Corrections

• Oct. 15, page 77: On the registration form of the 1990 ACS SE/SW Regional Meeting, a footnote to the $10 student registration fee indicates that this fee includes tickets to the Jazz Party. This is incorrect—an additional $25 is required to attend the party.

• Oct. 22, page 40: The 1990 ACS starting salary survey found the median starting salary for Ph.D. chemical engineers to be $50,000, which is 6% more (not less) than the 1989 median. Women chemical engineers at the bachelor's level start with 1% lower median salaries than men; at the master's level, women's median starting salaries are 2% higher than men's.

by 10 million tons annually. Nitrogen oxide emissions also will be reduced by 2 million tons to 4 million tons annually after 1997.

The acid rain program imposes a cap on emissions that affects all utilities, and is designed to preserve gains achieved. In addition, the program sets up a trading system, under which utilities making deep cuts earn credits of up to $500 for each ton of reduction. They can use these credits to build additional capacity or sell them to other utilities.

Some 15,000 miners of high-sulfur coal in the Midwest and Appalachia may lose their jobs as a result of this legislation. To protect them and others thrown out of work by the tightened regulations, the bill provides $250 million over five years for extra unemployment benefits, as long as a displaced worker remains in a retraining program.

Provisions for protecting the ozone layer are new to this revision and do not appear in the 1977 law. Production of ozone-destroying chlorofluorocarbons and carbon tetrachloride is to be halted by 2000. Production of methyl chloroform is outlawed two years later. Safer hydrochlorofluorocarbons are to be phased out after 1994, and their production is banned in 2030.

Automakers and oil companies are required to help curb smog through tighter controls on tailpipe emissions. Among the many provisions affecting them, automakers will have to begin in 1994 to phase in new cars emitting 60% less nitrogen oxides and 40% less hydrocarbons. Pollution control equipment will have to be built to last 10 years or 100,000 miles, instead of the current five years or 50,000 miles. Oil refiners will have to supply cleaner burning reformulated gasoline to the nation's nine smoggiest cities by 1995.

The American Petroleum Institute says it would like to meet the requirements of the new bill but doesn't know how to do it with existing technology. Richard E. Ayres, chairman of the National Clean Air Coalition (composed of environmental groups), claims the new bill's provision on urban smog "provides too long for too many to do too little."

No sector, industrial or environmental, is entirely happy with the bill. But all agree with Robert A. Roland, president of the Chemical Manufacturers Association, that "it will lead to continued progress in cleaning our nation's air." Ayres' coalition parts with Roland when he adds, "this continued progress won't come without a very high price."

Some noted economists deem the price too high and in a letter ask President Bush to veto the bill. However, the President is expected to sign it.

Lois Ember

Federal R&D funding generally up for 1991

Fiscal 1991 promises to be not a bad year at all for the majority of federally funded R&D activities. That's contrary to what might have been expected in a budget year that sees Congress and the Administration tying themselves in knots trying to come up with mutually agreeable ways of reducing the federal deficit.

At press time, Congress had completed work on all but two of the appropriation bills that fund federal R&D agencies. Remaining were one covering defense-related activities and another funding the Department of Interior and some Department of Energy programs.

Moreover, all of the agencies funded so far are getting increases—in some cases quite substantial ones for a time of "austere" budgets. For example, funding for the National Institutes of Health is up $710 million, or 10%, to just under $8 billion. Congress believes the amount it has provided for NIH "is sufficient to fund grants at the levels approved by the Institutes with no arbitrary downward negotiation of awards."

Not all programs within an agency are slated for equal increases. For example, funding for the DOE's basic energy sciences activities is up 23% to $716 million. But within that category, funding for chemical sciences is up just 10% to $159 million, while materials sciences is up 36% to $277 million. The materials sciences budget includes an additional $12 million over fiscal 1990 for work on the advanced neutron source at Oak Ridge National Laboratory.

Congress also provided a total of $243 million for DOE's Superconducting Super Collider. That's 12% more than the SSC project was allotted in fiscal 1990, but almost 25% less than the Administration wanted this year.

Overall funding for NSF is up 11% to $2.3 billion. Education and human resources activities are up

Research gets healthy increase in 1991

$ Millions	1991 Congress final	1991 Administration request	1990	% change 1990–91
NIH	**$ 7,987.2**	**$ 7,623.2**	**$ 7,276.8**	**10%**
NASA R&D	**6,023.6**	**7,074.0**	**5,227.8**	**15**
Energy	**3,675.8**	**3,379.0**	**3,283.2**	**12**
Supply R&D	2,527.1	2,105.3	2,184.4	16
General science & research	1,148.7	1,273.7	1,098.8	5
NSF	**2,316.0**	**2,383.0**	**2,080.6**	**11**
Research-related activities	1,694.2	1,954.0	1,592.8	6
USDA	**1,116.5**	**1,003.0**	**979.6**	**13**
ARS[a]	665.1	656.1	596.8	11
CSRS[b]	451.4	346.9	382.8	18
Commerce	**422.3**	**397.9**	**334.6**	**26**
Oceanic, atmospheric research	207.0	199.5	172.8	20
NIST[c]	215.3	198.4	161.8	33
EPA[d]	**254.9**	**249.0**	**229.8**	**11**
TOTAL	**$21,796.3**	**$22,109.1**	**$19,412.4**	**12%**

a Agricultural Research Service. b Cooperative State Research Service. c National Institute of Standards & Technology. d Fund for extramural R&D. **Source:** Congressional budget documents

58% to $322 million, and academic research facilities are up 4% to $20.5 million. Funding for NSF's research grants and related activities is up 6%. The Administration had sought a 15% increase, to just under $2 billion.

On a somewhat ominous note, Congress has directed NSF to arrange for a study by the National Academy of Sciences on the way NSF selects proposals for funding. Congress is particularly interested in the role played in "the decision process of merit review by outside scientists and executive agency staff."

Janice Long

Insect-killing cotton passes field tests

Successful first-year field trials have been carried out on cotton genetically altered to resist insect damage. The tests show that its use might allow a 35 to 40% reduction in insecticide applications on cotton, and the developer, Monsanto, hopes to improve the cotton to reduce pesticide use 80%.

Monsanto scientists prepared the test plants by inserting a gene from a commercially available natural bacterium, *Bacillus thuringiensis kurstaki*. The gene enables Bt to make a protein toxic to many caterpillar species, and the transgenic cotton makes a similar protein.

Monsanto conducted the field tests in six states in cooperation with the U.S. Department of Agriculture and several universities. "Nearly all the caterpillars died within four days," notes a USDA plant geneticist. The transgenic plants were about as bug-free as regular cotton sprayed with insecticide.

Monsanto's efforts to exploit biotechnology have not always been immediately successful. The company's effort to develop bovine somatotropin, a cow hormone that boosts milk production, has met resistance from farmers and government regulators. But the firm's foray into plant genetics has met with greater acceptance. According to David Altman, a geneticist at USDA's Southern Crops Research Laboratory in College Station, Tex., Monsanto's transgenic cotton "could provide additional pest control options for cotton growers."

About 15 million lb of pesticides are applied annually to the U.S. cotton crop, costing about $230 million, according to a Monsanto spokesman. Of this, 6 million lb are applied to control the type of caterpillars that the genetically altered cotton can repel. Caterpillars affected include the tobacco budworm, cotton bollworm, pink bollworm, and beet armyworm. However, the adult boll weevil, a major cotton pest, is unaffected.

Monsanto is not a major producer of insecticides, so use of transgenic cotton would not reduce its agricultural sales. Synthetic pyrethroids are now used to control caterpillar damage on cotton crops, notes a Monsanto spokesman, but the pests can build up tolerance to these frequently applied insecticides. Many growers spray more than 10 times a season. The genetically modified cotton would require fewer pyrethroid applications, and allow increased efficacy from the pyrethroids.

In addition, the transgenic plants are toxic only to the caterpillars that feed on the plants, and have no effect on humans or beneficial insects. Although Bt has been commercially available for the past 30 years, only frequent applications effectively controlled crop damage because it breaks down on exposure to light and readily washes off. The transgenic plants avoid these problems.

The altered plants pass the Bt gene on to succeeding generations through their seed, Monsanto explains. But because the firm is not a major seed producer, it plans to license the technology to produce the genetically altered cotton to cottonseed producers. It hopes commercial quantities of seed will be available in the mid-1990s. Although transgenic cottonseed will cost more than unaltered seed, the difference should be more than made up by reduced pesticide applications, says Monsanto.

Marc Reisch

Petrochemical profit decline may be easing

The full impact of the Persian Gulf crisis on U.S. petrochemical makers remains uncertain. However, there are indications the worst of the decline in profit margins since Iraq's invasion of Kuwait on Aug. 2 may be over. Crude oil prices—and with them feedstock prices—are easing, and product prices, although still lagging, are gradually rising.

Oil prices have taken a roller coaster ride since the invasion, declining recently to less than $29 per barrel, after more than doubling to as much as $41 per bbl earlier. Spot prices of natural gas-derived light hydrocarbon feedstocks, such as ethane and propane, also recently have dropped.

During the past three months, U.S. producers have raised prices for most basic petrochemicals and derivatives, such as plastics. However, the increases have lagged far behind the soaring prices of crude oil and light hydrocarbon feedstocks, squeezing profit margins. The effects have shown up as substantial declines in third-quarter earnings.

For example, ethylene and propylene prices rose less than one third while oil prices doubled. Ethylene for October delivery will be about 28 cents per lb, according to Gulf Coast industry sources. And quotes for November delivery range between 30 and 33 cents per lb.

Moreover, marketers of major volume plastics have announced price increases of 3 to 5 cents per lb for November, following increases this month—reflecting higher monomer costs. Demand for these plastics jumped in August as sales and captive use rose about 5% or more over August 1989, except for polystyrene (up just 0.3%).

However, if last week's lower oil prices hold, proposed increases in prices of chemicals could be rescinded. If crude oil holds in the $25- to $30-per-bbl range, for example, ethylene prices will stabilize at 30 cents per lb or less, industry sources say. And if war seems less likely, liquidation of plastics inventories could exert pressure on plastic prices.

Bruce Greek